Consolidated Glass CORPORATION

Diamond Tempered®

# Flat Glass Inspection Criteria per ASTM C 1036 – 11/ASTM C 1048-12

## Terminology:

***crush***,—lightly pitted condition with a dull gray appearance.

***dig***,—deep, short scratch

***gaseous inclusion***,—round or elongated bubble in the glass.

***linear blemish***,—scratches, rubs, digs, and other similar imperfections.

***point blemish***,—crush, knots, dirt, stones, gaseous inclusions, and other similar imperfections.

***rub***,—abrasion of a glass surface producing a frosted appearance.

***scratch***,—damage on a glass surface in the form of a line caused by the movement of an object across and in contact with the glass surface.

## Inspection:

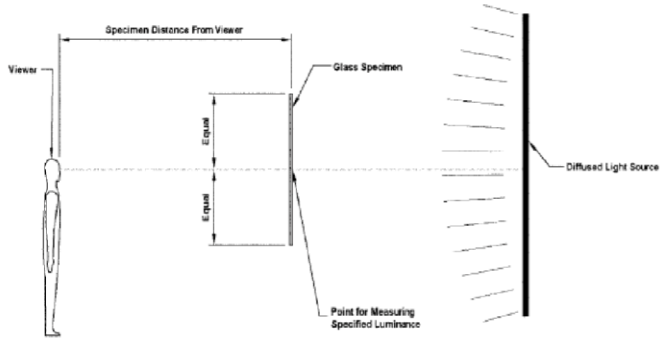
Visual inspection should be done with the naked eye

The inspector shall place the glass in a vertical position

Inspector shall view through the glass at an angle of 90º

Lighting should be daylight level (**without direct sunlight**)

*****View specimen from a distance of 6'*****




## Quality Criteria:

**Allowable Point Blemish, (viewing distance 39") –within oval viewing area**

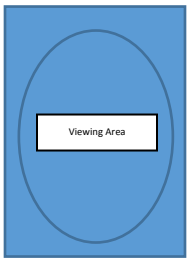
Blemish size <1.2mm (0.05") allowed without restriction on all areas of glass

Blemish size >1.2mm (0.05") <2.0mm (0.10") allowed with a minimum separation of 600mm (24") inside viewing area

Blemish size >2.0mm (0.10") none allowed inside viewing area

*To determine point blemish size, measure height and width of blemish and average. Only the point blemish is to be measured, and not any distortion that may be present.*

**Allowable Linear Blemish, (viewing distance starting at 6') -within oval viewing area**




Faint or light scratch <75mm (3") allowed on all areas of the glass

Medium scratch ≤75 (3") allowed with a minimum separation of 600mm (24") inside viewing area

Medium or heavy scratch >75mm (3") are not allowed inside viewing area

To determine scratch intensity start at 6' and move closer until scratch becomes visible, (refer to table)

******Strain pattern is considered a normal part of the heat treating process and is not considered a defect******

******Surface particles invisible to the naked eye are inherent in the heat-treating process and are not a cause for rejection******

| Detection Distance | Blemish Intensity |
|---|---|
| Over 3.3 m (132 in.) | Heavy |
| 3.3 to 1.01 m (132 to 40 in.) | Medium |
| 1 to 0.2 m (39 to 8 in.) | Light |
| Less than 0.2 m (8 in.) | Faint |

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# Laminated Glass Inspection Criteria per ASTM C 1172 – 11

## Terminology:

***blow-in***—a separation of glass and interlayer at or close to the laminate edge caused by penetration of the autoclaving medium into the edge during manufacturing.

***boil (bubble)***—a gas pocket in the interlayer material or between the glass and interlayer.

***covered edge***—the parametric area of the laminate covered by the channel or sash when installed.

***delamination***—a condition in which one or two of the lites of glass loses the bond between the glass lite and the interlayer.

***discoloration***—a visibly noticeable color change (from original) in the appearance of a material.

***edge boil***—See *boil (bubble)*.

***exposed edge***—the parametric area of the laminate exposed to the environment after installation.

***fuse***—a glass particle or crystalline material that is permanently bonded to a surface of a lite.

***inside dirt***—foreign material trapped inside the laminate.

***lint***—short fibers of yarn or fabric trapped within the laminate.

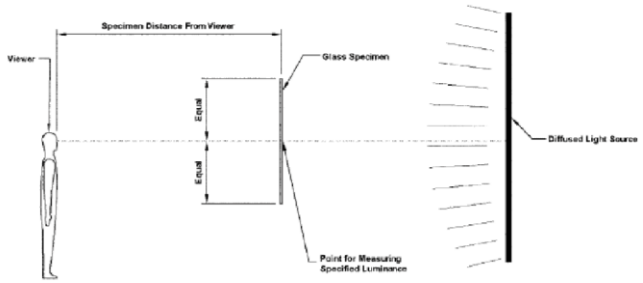
***scuff***—See *streak.*

***separation***—an area of the laminate that has become delaminated (see *delamination*).

***streak***—a noticeably visible deviation on or in the laminating unit.

## Inspection:

For inspection of individual glass lites refer to ASTM C 1036-11 .




Visual inspection should be done with the naked eye.

The inspector shall place the glass in a vertical position

Inspector shall view through the glass at an angle of 90º

Lighting should be daylight level (**without direct sunlight**)

*****View specimen from a distance of 6'*****

## Quality Criteria:

1. Determine approximate lite surface area ($ft^2$).
2. Determine defect location – central or outer viewing area. (The central area is considered to form a square or rectangle defined by the center 80 % of the length and 80 % of the width dimensions centered on a lite of glass. The remaining area is considered the outer area)
3. Evaluate defect according to the following table. ◦ CE = =covered edge of glass edge bite and EE = exposed edge. (If CE or EE is unknown use CE tolerance.)

| Blemish | Up to 25 $ft^2$ (2.5 $m^2$) | | 25 to 75 $ft^2$ (2.5 to 7.0 $m^2$) | | Over 75 $ft^2$ (7.0 $m^2$) | |
|---|---|---|---|---|---|---|
| | Central[A] | Outer[A] | Central[A] | Outer[A] | Central[A] | Outer[A] |
| Boil (Bubbles)<br>Blow-in; edge boil | 1/16 (1.6)[B] | 3/32 (2.4)<br>CE 1/4 (6.4)<br>EE 1/32 (0.8)[C] | 1/8 (3.2)[B] | 3/16 (4.8)<br>CE 1/4 (6.4)<br>EE 1/16 (1.6)[C] | 1/4 (6.4)[B] | 1/4 (6.4)<br>CE 5/16 (8.0)<br>EE 3/32 (2.3)[C] |
| Fuse | 1/32 (0.8) | 1/16 (1.6) | 1/16 (1.6) | 3/32 (2.4) | 3/32 (2.4) | 5/32 (4.0) |
| Hair, lint (single strand) | light intensity[D] | medium intensity[E] | light intensity[D] | medium intensity[E] | medium intensity[E] | medium intensity[E] |
| Inside dirt (dirt spot) | 1/16 (1.6) | 3/32 (2.4) | 3/32 (2.4) | 5/32 (4.0) | 1/8 (3.2) | 3/16 (4.8) |
| Lint-areas of concentrated lint | light intensity[D] | light intensity[D] | light intensity[D] | light intensity[D] | light intensity[D] | light intensity[D] |
| Separation, discoloration | none | none | none | none | none | none |
| Short interlayer; unlaminated area chip | [B] | CE 1/4 (6.4)<br>EE 1/16 (1.6)[C] | [B] | CE 1/4 (6.4)<br>EE 3/32 (2.4)[C] | [B] | CE 1/4 (6.4)<br>EE 1/8 (3.2)[C] |
| Scuff; streak | light intensity[D] | light intensity[D] | light intensity[D] | light intensity[D] | light intensity[D] | light intensity[D] |

To establish light and medium intensity for a specific defect, view starting at 11 ft. moving forward down to 36".

Light intensity – Barely noticeable at 36" Medium Intensity – Noticeable at 36" but not 11 ft.

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# Heat treated Glass Inspection Criteria per ASTM C 1048 – 11

## Terminology:

***bow/warp,*** —Curvature across the entire dimension(s) of the lite

***crush***,—lightly pitted condition with a dull gray appearance.

***dig***,—deep, short scratch

***dirt***,—small particle of foreign matter embedded in the surface of flat glass.

***distortion,*** —Thermally tempered and heat-strengthened glass is made by heating glass in a furnace, the original flatness of the glass is slightly modified by the heat treatment, causing reflected images to be distorted.

***gaseous inclusion***,—round or elongated bubble in the glass.

***linear blemish***,—scratches, rubs, digs, and other similar imperfections.

***point blemish***,—crush, knots, dirt, stones, gaseous inclusions, and other similar imperfections.

***rub***,—abrasion of a glass surface producing a frosted appearance.

***scratch***,—damage on a glass surface in the form of a line caused by the movement of an object across and in contact with the glass surface.

***strain pattern,***—In heat-strengthened and fully tempered glass, a strain pattern, which is not normally visible, may become visible under certain light conditions.

## Inspection:

Linear and point blemishes in glass should be evaluated per ASTM C 1036 – 11.

Coating related defects should be evaluated per ASTM C 1376 – 11.

Strain pattern, this is considered a normal part of the heat treating process and is not considered a defect.

Distortion, at this time no industry quality standards exist.

Bow and warp, see below.

******Strain pattern is considered a normal part of the heat treating process and is not considered a defect******

******Surface particles invisible to the naked eye are inherent in the heat-treating process and are not a cause for rejection******

## Quality Criteria:

### Maximum Allowed Bow and Warp

Place glass in a vertical position with glass resting on blocks.

Place a straight edge across the concave surface.

Measure widest gap with a fine scale ruler.

Refer to table for to determine maximum allowable bow\warp.

## Table: Maximum Allowed Bow and Warp

| | Edge Dimension, cm (in.) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0–50 (0–20) | >50–90 (>20–35) | >90–120 (>35–47) | >120–150 (>47–59) | >150–180 (>59–71) | >180–210 (>71–83) | >210–240 (>83–94) | >240–270 (>94–106) | >270–300 (>106–118) | >300–330 (>118–130) | >330–370 (>130–146) | >370–400 (>146–158) |
| Glass Thickness, mm (in.) | Maximum Bow and Warp, mm (in.) | | | | | | | | | | | |
| 3 (⅛) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) | ... | ... | ... |
| 3 (⅛) Alternate Method[4] | 2.0 (0.08) | 2.0 (0.08) | 2.0 (0.08) | 3.0 (0.12) | 5.0 (0.20) | 6.0 (0.24) | 7.0 (0.28) | 8.0 (0.31) | 10.0 (0.39) | ... | ... | ... |
| 4 (5/32) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) | ... | ... | ... |
| 5 (3/16) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) | ... | ... | ... |
| 6 (¼) | 2.0 (0.09) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) | 21.0 (0.83) | 24.0 (0.94) |
| 8 (5/16) | 2.0 (0.08) | 2.0(0.08) | 3.0 (0.12) | 4.0 (0.16) | 5.0 (0.20) | 6.0 (0.24) | 8.0 (0.31) | 10.0 (0.39) | 13.0 (0.51) | 15.0 (0.59) | 18.0 (0.71) | 20.0 (0.79) |
| 10 (⅜) | 2.0 (0.08) | 2.0 (0.08) | 2.0 (0.08) | 4.0 (0.16) | 5.0 (0.20) | 6.0 (0.24) | 7.0 (0.28) | 9.0 (0.35) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) | 19.0 (0.75) |
| 12–22 (½–⅞) | 1.0 (0.04) | 2.0 (0.08) | 2.0 (0.08) | 2.0 (0.08) | 4.0 (0.16) | 5.0 (0.20) | 5.0 (0.20) | 7.0 (0.28) | 10.0 (0.39) | 12.0 (0.47) | 14.0 (0.55) | 17.0 (0.67) |